What is claimed is:

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1. A system for detecting an analyte in a fluid comprising:

a light source;

a sensor array, the sensor array comprising a supporting member comprising at least one cavity formed within the supporting member;

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a particle, the particle positioned within the cavity, wherein the particle is configured to produce a signal when the particle interacts with the analyte during use; and

a detector, the detector being configured to detect the signal produced by the interaction of the analyte with the particle during use;

wherein the light source and detector are positioned such that light passes from the light source, to the particle, and onto the detector during use.

2. The system of claim 1, wherein the system comprises a plurality of particles positioned within a plurality of cavities, and wherein the system is configured to substantially simultaneously detect a plurality of analytes in the fluid.

3. The system of claim 1, wherein the system comprises a plurality of particles positioned within the cavity.

4. The system of claim 1, wherein the light source comprises a light emitting diode.

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5. The system of claim 1, wherein the light source comprises a white light source.

6. The system of claim 1, wherein the sensor array further comprises a bottom layer and a top cover layer, wherein the bottom layer is positioned below a bottom surface of the supporting member, and wherein the top cover layer is positioned above the upper surface of the supporting member, and wherein the bottom layer and the top cover layer are positioned such that the particle is substantially contained within the cavity by the bottom layer and the top cover layer.

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7. The system of claim 6, wherein the bottom layer and the top cover layer are substantially transparent to light produced by the light source.

8. The system of claim 1, wherein the sensor array further comprises a bottom layer and a top cover layer, wherein the bottom layer is coupled to a bottom surface of the supporting member, and wherein the top cover layer is coupled to a top surface of the supporting member; and wherein both the bottom layer and the top cover layer are coupled to the supporting member such that the particle is substantially contained within the cavity by bottom layer and the top cover layer.

9. The system of claim 8, wherein the bottom layer and the top cover layer are substantially transparent to light produced by the light source.

10. The system of claim 1, wherein the sensor array further comprises a bottom layer coupled to the supporting member, and wherein the supporting member comprises silicon, and wherein the bottom layer comprises silicon nitride.

11. The system of claim 1, wherein the sensor array further comprises a sensing cavity formed on a bottom surface of the sensor array.

12. The system of claim 1, wherein the supporting member is formed from a plastic material, and wherein the sensor array further comprises a top cover layer, the top cover layer being coupled to the supporting member such that the particle is substantially contained within the cavity, and wherein the top cover layer is configured to allow the fluid to pass through the top cover layer to the particle, and wherein both the supporting member and the top cover layer are substantially transparent to light produced by the light source.

13. The system of claim 1, further comprising a fluid delivery system coupled to the supporting member.

14. The system of claim 1, wherein the detector comprises a charge-coupled device.

15. The system of claim 1, wherein the detector comprises an ultraviolet detector.

16. The system of claim 1, wherein the detector comprises a fluorescence detector.

17. The system of claim 1, wherein the detector comprises a semiconductor based photodetector, and wherein the detector is coupled to the sensor array.

18. The system of claim 1, wherein the particle ranges from about 0.05 micron to about 500 microns.

19. The system of claim 1, wherein a volume of the particle changes when contacted with the fluid.

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20. The system of claim 1, wherein the particle comprises a metal oxide particle.

21. The system of claim 1, wherein the particle comprises a metal quantum particle.

22. The system of claim 1, wherein the particle comprises a semiconductor quantum particle.

23. The system of claim 1, wherein the particle comprises a receptor molecule coupled to a polymeric resin.

24. The system of claim 23, wherein the polymeric resin comprises polystyrene-polyethylene glycol-divinyl benzene.

25. The system of claim 23, wherein the receptor molecule produces the signal in response to the pH of the fluid.

26. The system of claim 23, wherein the analyte comprises a metal ion, and wherein the receptor produces the signal in response to the presence of the metal ion.

27. The system of claim 23, wherein the analyte comprises a carbohydrate, and wherein the receptor produces a signal in response to the presence of a carbohydrate.

28. The system of claim 23, wherein the particles further comprises a first indicator and a second indicator, the first and second indicators being coupled to the receptor, wherein the interaction of the receptor with the analyte causes

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the first and second indicators to interact such that the signal is produced.

29. The system of claim 23, wherein the particles further comprises an indicator, wherein the indicator is associated with the receptor such that in the presence of the analyte the indicator is displaced from the receptor to produce the signal.

30. The system of claim 23, wherein the receptor comprises a polynucleotide.

31. The system of claim 23, wherein the receptor comprises a peptide.

32. The system of claim 23, wherein the receptor comprises an enzyme.

33. The system o f claim 23, wherein the receptor comprises a synthetic receptor.

34. The system of claim 23, wherein the receptor comprises an unnatural biopolymer.

35. The system of claim 23, wherein the receptor comprises an antibody.

36. The system of claim 23, wherein the receptor comprises an antigen.

37. The system of claim 1, wherein the analyte comprises phosphate functional groups, and wherein the particle is configured to produce the signal in the presence of the phosphate functional groups.

38. The system of claim 1, wherein the analyte comprises bacteria, and wherein the particle is configured to produce the signal in the presence of the bacteria.

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39. The system of claim 1, wherein the system comprises a plurality of particles positioned within a plurality of cavities, and wherein the plurality of particles produce a detectable pattern in the presence of the analyte.

40. A system for detecting an analyte in a fluid comprising:

a light source;

a sensor array, the sensor array comprising a supporting member comprising a plurality of cavities formed within the supporting member, wherein the supporting member comprises silicon;

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a plurality of particles, the particles comprising a receptor molecule covalently linked to a polymeric resin, wherein the particles are positioned within the cavities, and wherein each of the particles is configured to produce a signal when the particle interacts with the analyte during use; and

a detector configured to detect the signal produced by the interaction of the analyte with the particle during use;

wherein the light source and detector are positioned such that light passes from the light source, to the particle, and onto the detector during use.

41. The system of claim 40, wherein the system is configured to substantially simultaneously detect a plurality of analytes in the fluid.

42. The system of claim 40, wherein each cavity is configured to hold a single particle.

43. The system of claim 40, wherein each cavity is configured to hold a plurality of particles.

44. The system of claim 40, wherein the sensor array further comprises a bottom layer and a top cover layer, wherein the bottom layer is positioned below a bottom surface of the supporting member, and wherein the top cover layer is positioned above the upper surface of the supporting member, and wherein the bottom layer and the top cover layer are positioned such that the particle is substantially contained within the cavity by the bottom layer and the top cover layer.

45. The system of claim 44, wherein the bottom layer and the top cover layer are substantially transparent to light produced by the light source.

46. The system of claim 40, wherein the sensor array further comprises a bottom layer and a top cover layer, wherein the bottom layer is coupled to a bottom surface of the supporting member, and wherein the top cover layer is coupled to a top surface of the supporting member; and wherein both the bottom layer and the top cover layer are coupled to the supporting member such that the particle is substantially contained within the cavity by bottom layer and the top cover layer.

47. The system of claim 46, wherein the bottom layer and the top cover layer are substantially transparent to light produced by the light source.

48. The system of claim 40, wherein the sensor array further comprises a bottom layer coupled to the supporting member, and wherein the bottom layer comprises silicon nitride.

49. The system of claim 40, wherein the sensor array further comprises a sensing cavity formed on a bottom surface of the sensor array.

50. The system of claim 40, further comprising a fluid delivery system coupled to the supporting member.

51. The system of claim 40, wherein the detector comprises a charge-coupled device.

52. The system of claim 40, wherein the detector comprises a semiconductor based photodetector, and wherein the detector is coupled to the sensor array.

53. The system of claim 40, wherein the particle ranges from about 0.05 micron to about 500 microns.

54. The system of claim 40, wherein a volume of the particle changes when contacted with the fluid.

55. The system of claim 40, wherein the polymeric bead comprises a polystyrene-polyethylene glycol-divinyl benzene resin.

56. The system of claim 40, wherein the receptor molecule produces the signal in response to the pH of the fluid.

57. The system of claim 40, wherein the analyte comprises a metal ion, and wherein the receptor produces the signal in response to the presence of the metal ion.

58. The system of claim 40, wherein the analyte comprises a carbohydrate, and

wherein the receptor produces a signal in response to the presence of the carbohydrate.

59. The system of claim 40, wherein the particles further comprises a first indicator and a second indicator, the first and second indicators being coupled to the receptor, wherein the interaction of the receptor with the analyte causes the first and second indicators to interact such that the signal is produced.

60. The system of claim 40, wherein the particles further comprises an indicator, wherein the indicator is associated with the receptor such that in the presence of the analyte the indicator is displaced from the receptor to produce the signal.

61. The system of claim 40, wherein the receptor comprises a polynucleotide.

62. The system of claim 40, wherein the receptor comprises a peptide.

63. The system of claim 40, wherein the receptor comprises an enzyme.

64. The system o f claim 40, wherein the receptor comprises a synthetic receptor.

65. The system of claim 40, wherein the receptor comprises an unnatural biopolymer.

66. The system of claim 40, wherein the receptor comprises an antibody.

67. The system of claim 40, wherein the receptor comprises an antigen.

68. The system of claim 40, wherein the particles produce a detectable pattern in

the presence of the analyte.

69. A sensor array for detecting an analyte in a fluid comprising:

a supporting member; wherein at least one cavity is formed within the supporting member;

a particle positioned within the cavity, wherein the particle is configured to produce a signal when the particle interacts with the analyte.

70. The sensor array of claim 69, further comprising a plurality of particles positioned within the cavity.

71. The sensor array of claim 69, wherein the particle comprises a receptor molecule coupled to a polymeric resin.

72. The sensor array of claim 69, wherein the particle has a size ranging from about 0.05 micron to about 500 microns in diameter.

73. The sensor array of claim 69, wherein the particle has a size ranging from about 0.05 micron to about 500 microns in diameter, and wherein the cavity is configured to substantially contain the particle.

74. The sensor array of claim 69, wherein the supporting member comprises a plastic material.

75. The sensor array of claim 69, wherein the supporting member comprises a silicon wafer.

76. The sensor array of claim 75, wherein the cavity extends through the silicon wafer.

77. The sensor array of claim 75,wherein the cavity is substantially pyramidal in shape and wherein the sidewalls of the cavity are substantially tapered at an angle of between about 50 to about 60 degrees.

78. The sensor array of claim 75, further comprising a substantially transparent layer positioned on a bottom surface of the silicon wafer.

79. The sensor array of claim 75, further comprising a substantially transparent layer positioned on a bottom surface of the silicon wafer, wherein the substantially transparent layer comprises silicon dioxide, silicon nitride, or silicon oxide/silicon nitride multilayer stacks.

80. The sensor array of claim 75, further comprising a substantially transparent layer positioned on a bottom surface of the silicon wafer, wherein the substantially transparent layer comprises silicon nitride.

81. The sensor array of claim 75, wherein the silicon wafer has an area of about 1 cm^2 to about 100 cm^2.

82. The sensor array of claim 75, further comprising a plurality of cavities formed in the silicon wafer, and wherein from about 10 to about 10^6 cavities are formed in the silicon wafer.

83. The sensor array of claim 69, further comprising channels in the supporting member, wherein the channels are configured to allow the fluid to flow

through the channels into and away from the cavity.

84. The sensor array of claim 69, further comprising an inner surface coating, wherein the inner surface coating is configured to inhibit dislodgment of the particle.

85. The sensor array of claim 69, further comprising a detector coupled to the bottom surface of the supporting member, wherein the detector is positioned below the cavity.

86. The sensor array of claim 85, wherein the detector is a semiconductor based photodetector.

87. The sensor array of claim 85, wherein the detector is a Fabry-Perot type detector.

88. The sensor array of claim 85, further comprising an optical fiber coupled to the detector, wherein the optical fiber is configured to transmit optical data to a microprocessor.

89. The sensor array of claim 69, further comprising an optical filters coupled to a bottom surface of the sensor array.

90. The sensor array of claim 69, further comprising a barrier layer positioned over the cavity, the barrier layer being configured to inhibit dislodgment of the particle during use.

91. The sensor array of claim 90, wherein the barrier layer comprises a substantially transparent cover plate positioned over the cavity, and wherein

the cover plate is positioned a fixed distance over the cavity such that the fluid can enter the cavity.

92. The sensor array of claim 91, wherein the barrier layer comprises plastic, glass, quartz, silicon oxide, or silicon nitride.

93. The sensor array of claim 69, further comprising a plurality of particles positioned within a plurality of cavities formed in the supporting member.

94. The sensor array of claim 69, wherein the system comprises a plurality of particles positioned within a plurality of cavities, and wherein the plurality of particles produce a detectable pattern in the presence of the analyte.

95. A sensor array for detecting an analyte in a fluid comprising:

a supporting member, wherein the supporting member comprises a silicon wafer, and wherein a plurality of cavities are formed within the supporting member;

a plurality of particles, at least one particle being positioned in each of the cavities, wherein the particles are configured to produce a signal when the particles interact with the analyte.

96. The sensor array of claim 95, wherein a plurality of particles is positioned within each of the cavities.

97. The sensor array of claim 95, wherein the particles comprise a receptor molecule coupled to a polymeric bead.

98. The sensor array of claim 95, wherein the cavity extends through the supporting member.

99. The sensor array of claim 95,wherein the cavity is substantially pyramidal in shape and wherein the sidewalls of the cavity are substantially tapered at an angle of between about 50 to about 60 degrees.

100. The sensor array of claim 95, further comprising a substantially transparent layer positioned on a bottom surface of the supporting member.

101. The sensor array of claim 95, further comprising a substantially transparent layer positioned on a bottom surface of the silicon wafer, wherein the substantially transparent layer comprises silicon dioxide, silicon nitride, or silicon oxide/silicon nitride multilayer stacks.

102. The sensor array of claim 95, further comprising a substantially transparent layer positioned on a bottom surface of the silicon wafer, wherein the substantially transparent layer comprises silicon nitride.

103. The sensor array of claim 95, wherein the silicon wafer has an area of about 1 cm^2 to about 100 cm^2.

104. The sensor array of claim 95, further comprising a plurality of cavities formed in the silicon wafer, and wherein from about 10 to about 10^6 cavities are formed in the silicon wafer.

105. The sensor array of claim 95, further comprising channels in the supporting member, wherein the channels are configured to allow the fluid to flow through the channels into and away from the cavities.

106. The sensor array of claim 95, further comprising an inner surface coating, wherein the inner surface coating is configured to inhibit dislodgment of the particle.

107. The sensor array of claim 95, further comprising a detector coupled to the bottom surface of the supporting member, wherein the detector is positioned below the cavity.

108. The sensor array of claim 107, wherein the detector is a semiconductor based photodetector.

109. The sensor array of claim 107, wherein the detector is a Fabry-Perot type detector.

110. The sensor array of claim 107, further comprising an optical fiber coupled to the detector, wherein the optical fiber is configured to transmit optical data to a microprocessor.

111. The sensor array of claim 95, further comprising a barrier layer positioned over the cavity, the barrier layer being configured to inhibit dislodgment of the particle during use.

112. The sensor array of claim 111, wherein the barrier layer comprises a cover plate positioned over the cavity, and wherein the cover plate is positioned a fixed distance over the cavity such that the fluid can enter the cavity.

113. The sensor array of claim 111, further comprising channels in the supporting member, wherein the channels are configured to allow the fluid to flow

through the channels into and away from the cavities, and wherein the barrier layer comprises a cover plate positioned upon an upper surface of the supporting member, and wherein the cover plate inhibits passage of the fluid into the cavities such that the fluid enters the cavities via the channels.

114. The sensor array of claim 111, wherein the barrier layer comprises plastic, glass, quartz, silicon oxide, or silicon nitride.

115. A method for forming a sensor array configured to detect an analyte in a fluid, comprising:

forming a cavity in a supporting member, wherein the supporting member comprises a silicon wafer;

placing a particle in the cavity, wherein the particle is configured to produce a signal when the particle interacts with the analyte; and

forming a cover upon a portion of the supporting member, wherein the cover is configured to inhibit dislodgment of the particle from the cavity.

116. The method of claim 115, wherein forming the cavity comprises anisotropically etching the silicon wafer.

117. The method of claim 115, wherein forming the cavity comprises anisotropically etching the silicon wafer with a wet hydroxide etch.

118. The method of claim 115, wherein forming the cavity comprises anisotropically etching the silicon wafer such that sidewalls of the cavity are tapered at an angle from about 50 degrees to about 60 degrees.

119. The method of claim 115, wherein the silicon wafer has an area of about 1 cm^2 to about 100 cm^2.

120. The method of claim 115, further comprising forming a substantially transparent layer upon a bottom surface of the silicon wafer below the cavity.

121. The method of claim 115, further comprising forming a substantially transparent layer upon a bottom surface of the silicon wafer, wherein the cavity extends through the silicon wafer and wherein the substantially transparent layer is positioned to support the particle.

122. The method of claim 115, wherein the substantially transparent layer comprises silicon nitride.

123. The method of claim 115, wherein the cover comprises plastic, glass, quartz, silicon nitride, or silicon oxide.

124. The method of claim 115, wherein forming the cover comprises coupling the cover to the silicon wafer at a distance above the silicon wafer substantially less than a width of the particle.

125. The method of claim 115, further comprising etching channels in the silicon wafer prior to forming the cover on the silicon wafer, wherein forming the cover comprises placing the cover against the upper surface of the silicon wafer, and wherein the channels are configured to allow the fluid to pass through the silicon wafer to and from the cavities.

126. The method of claim 115, further comprising coating an inner surface of the

cavity with a material to increase adhesion of the particle to the inner surface of the cavity.

127. The method of claim 115, further comprising coating an inner surface of the cavity with a material to increase reflectivity of the inner surface of the cavity.

128. The method of claim 115, further comprising forming an optical detector upon a bottom surface of the supporting member below the cavity.

129. The method of claim 115, further comprising forming a sensing cavity upon a bottom surface of the supporting member below the cavity.

130. The method of claim 129, wherein forming the sensing cavity comprises:

forming a barrier layer upon a bottom surface of the silicon wafer;

forming a bottom diaphragm layer upon the barrier layer;

forming etch windows extending through the bottom diaphragm layer;

forming a sacrificial spacer layer upon the bottom diaphragm layer;

removing a portion of the spacer layer;

forming a top diaphragm layer; and

removing a remaining portion of the spacer layer.

131. The method of claim 130, further comprising filling a portion of the sensing

cavity with a sensing substrate.

132. The method of claim 115, further comprising forming an optical filter upon the bottom surface of the supporting member.

133. The method of claim 115, further comprising forming a plurality of cavities in the silicon wafer.

134. The method of claim 115, wherein from about 10 to about 10^6 cavities are formed in the silicon wafer.

135. A sensor array produced by the method of claim 115.

136. A method of sensing an analyte in a fluid comprising:

passing a fluid over a sensor array, the sensor array comprising at least one particle positioned within a cavity of a supporting member;

monitoring a spectroscopic change of the particle as the fluid is passed over the sensor array, wherein the spectroscopic change is caused by the interaction of the analyte with the particle.

137. The method of claim 136, wherein the spectroscopic change comprises a change in absorbance of the particle.

138. The method of claim 136, wherein the spectroscopic change comprises a change in fluorescence of the particle.

139. The method of claim 136, wherein the spectroscopic change comprises a

change in phosphorescence of the particle.

140. The method of claim 136, wherein the analyte is a proton atom, and wherein the spectroscopic change is produced when the pH of the fluid is varied, and wherein monitoring the spectroscopic change of the particle allows the pH of the fluid to be determined.

141. The method of claim 136, wherein the analyte is a metal cation, and wherein the spectroscopic change is produced in response to the presence of the metal cation in the fluid.

142. The method of claim 136, wherein the analyte is an anion, and wherein the spectroscopic change is produced in response to the presence of the anion in the fluid.

143. The method of claim 136, wherein the analyte is a DNA molecule, and wherein the spectroscopic change is produced in response to the presence of the DNA molecule in the fluid.

144. The method of claim 136, wherein the analyte is a protein, and wherein the spectroscopic change is produced in response to the presence of the protein in the fluid.

145. The method of claim 136, wherein the analyte is a metabolite, and wherein the spectroscopic change is produced in response to the presence of the metabolite in the fluid.

146. The method of claim 136, wherein the analyte is a sugar, and wherein the spectroscopic change is produced in response to the presence of the sugar in

the fluid.

147. The method of claim 136, wherein the analyte is a bacteria, and wherein the spectroscopic change is produced in response to the presence of the bacteria in the fluid.

148. The method of claim 136, wherein the particle comprises a receptor coupled to a polymeric resin, and further comprising exposing the particle to an indicator prior to passing the fluid over the sensor array.

149. The method of claim 148, wherein a binding strength of the indicator to the receptor is less than a binding strength of the analyte to the receptor.

150. The method of claim 148, wherein the indicator is a fluorescent indicator.

151. The method of claim 136, further comprising treating the fluid with an indicator prior to passing the fluid over the sensor array, wherein the indicator is configured to couple with the analyte.

152. The method of claim 136, wherein the analyte is bacteria and further comprising breaking down the bacteria prior to passing the fluid over the sensor array.

153. The method of claim 136, wherein monitoring the spectroscopic change is performed with a CCD device.

154. The method of claim 136, further comprising measuring the intensity of the spectroscopic change, and further comprising calculating the concentration of the analyte based on the intensity of the spectroscopic change.

155. A sensor array for detecting an analyte in a fluid comprising:

a supporting member, wherein the supporting member comprises a silicon wafer, and wherein a plurality of cavities are formed within the supporting member;

a plurality of particles, at least one particle being positioned in each of the cavities, wherein the particles are configured to produce a signal when the particles interact with the analyte.

156. A method of sensing an analyte in a fluid comprising:

passing a fluid over a sensor array, the sensor array comprising:

a supporting member, wherein the supporting member comprises a silicon wafer, and wherein a plurality of cavities are formed within the supporting member; and

a plurality of particles, at least one particle being positioned in each of the cavities, wherein the particles are configured to produce a signal when the particles interact with the analyte at least one particle positioned within a cavity of a supporting member;

monitoring a spectroscopic change of the particle as the fluid is passed over the sensor array, wherein the spectroscopic change is caused by the interaction of the analyte with the particle.

157. The method of claim 156, wherein the spectroscopic change comprises a

change in absorbance of the particle.

158. The method of claim 156, wherein the spectroscopic change comprises a change in reflectance of the particle.

159. The method of claim 156, wherein the spectroscopic change comprises a change in fluorescence of the particle.

160. The method of claim 156, wherein the spectroscopic change comprises a change in phosphorescence of the particle.

161. The method of claim 156, wherein the analyte is a proton atom, and wherein the spectroscopic change is produced when the pH of the fluid is varied, and wherein monitoring the spectroscopic change of the particle allows the pH of the fluid to be determined.

162. The method of claim 156, wherein the analyte is a metal cation, and wherein the spectroscopic change is produced in response to the presence of the metal cation in the fluid.

163. The method of claim 156, wherein the particle comprises a receptor coupled to a polymeric resin, and further comprising exposing the particle to an indicator prior to passing the fluid over the sensor array.

164. The method of claim 156, wherein a binding strength of the indicator to the receptor is less than a binding strength of the analyte to the receptor.

165. The method of claim 156, wherein the indicator is a fluorescent indicator.

166. The method of claim 156, further comprising treating the fluid with an indicator prior to passing the fluid over the sensor array, wherein the indicator is configured to couple with the analyte.

167. The method of claim 156, wherein the analyte is bacteria and further comprising breaking down the bacteria prior to passing the fluid over the sensor array.

168. The method of claim 156, wherein monitoring the spectroscopic change is performed with a CCD device.

169. The method of claim 156, further comprising measuring the intensity of the spectroscopic change, and further comprising calculating the concentration of the analyte based on the intensity of the spectroscopic change.

170. A system for detecting an analyte in a fluid comprising:

a light source;

a sensor array, the sensor array comprising at least one particle coupled to the sensor array, wherein the particle is configured to produce a signal when the particle interacts with the analyte; and

a detector configured to detect the signal produced by the interaction of the analyte with the particle;

wherein the light source and detector are positioned such that light passes from the light source, to the particle, and onto the detector during use.

171. A sensor array for detecting an analyte in a fluid comprising:

at least one particle coupled to the sensor array, wherein the particle is configured to produce a signal when the particle interacts with the analyte.

172. A method of sensing an analyte in a fluid comprising:

passing a fluid over a sensor array, the sensor array comprising at least one particle coupled to a supporting member;

monitoring a spectroscopic change of the particle as the fluid is passed over the sensor array, wherein the spectroscopic change is caused by the interaction of the analyte with the particle.